



Airline Operations Center



- An airline operations center (AOC) is an airline's global headquarters for aircraft dispatchers and other personnel
- Dispatchers have the authority to originate and terminate flights
- They generate flight plans and monitor flights throughout their routes
- AOCs also provide other functions, such as crew scheduling and maintenance management

AOC Research Areas



- AOC automation
 - Applied IBM's Watson "cognitive computing" to airline operations
 - Objective was to improve access to documents (e.g., FAA regulations, airline procedures, etc.) and Internet resources
- Winter weather
 - Developing a decision support tool to support operations during winter storms
- Improving partnerships with airline industry
- Creating AOC laboratory to support research
 - In Ames Human Systems Integration Division

AOC Automation



- Contracted with IBM for a feasibility study to apply Watson to support the AOC
- Delivered report in December 2015
- Report outlines how Watson could be applied to the AOC to improve access to and interpretation of the large amounts of data needed by dispatchers and other airline personnel



Cognitive Computing



- Cognitive computing systems are trained using artificial intelligence and machine learning algorithms to sense, predict, infer and, in some ways, think
- They can process natural language and unstructured data and learn by experience, much in the same way humans do
- They help human experts make better decisions by penetrating the complexity of “Big Data”
- Cognitive computing systems improve over time as they build knowledge and learn a domain
- By using visual analytics and data visualization techniques, cognitive computers display data in a visually compelling way that enlightens humans and helps them make decisions
- IBM has already developed and demonstrated cognitive computing in industry and medicine

The above is quoted from: <http://www.research.ibm.com/cognitive-computing>

Watson for AOC



- IBM report (December 2015) recommended two phases of Watson AOC deployment
 - Static data (large documents, etc.)
 - Gather data from Internet and air/ground messaging
- Requested NASA funding to cover Phase 1
- Other NASA centers are exploring Watson applications
- No further Watson work for the AOC anticipated for now
- IBM now owns WSI, which has the Fusion AOC system
 - May incorporate Watson

Winter Weather



- Developing the “Flight Awareness Collaboration Tool” (FACT)
- Concentrates information about winter weather events on one display
- Includes predictive tools
- Supports collaboration between AOC, air traffic control, airport authority, and de-icing operation
- User interface developed and application coding is underway
- Space Act Agreement with Virgin America
 - Backup AOC at Ames
- User group at Detroit airport

FACT Information



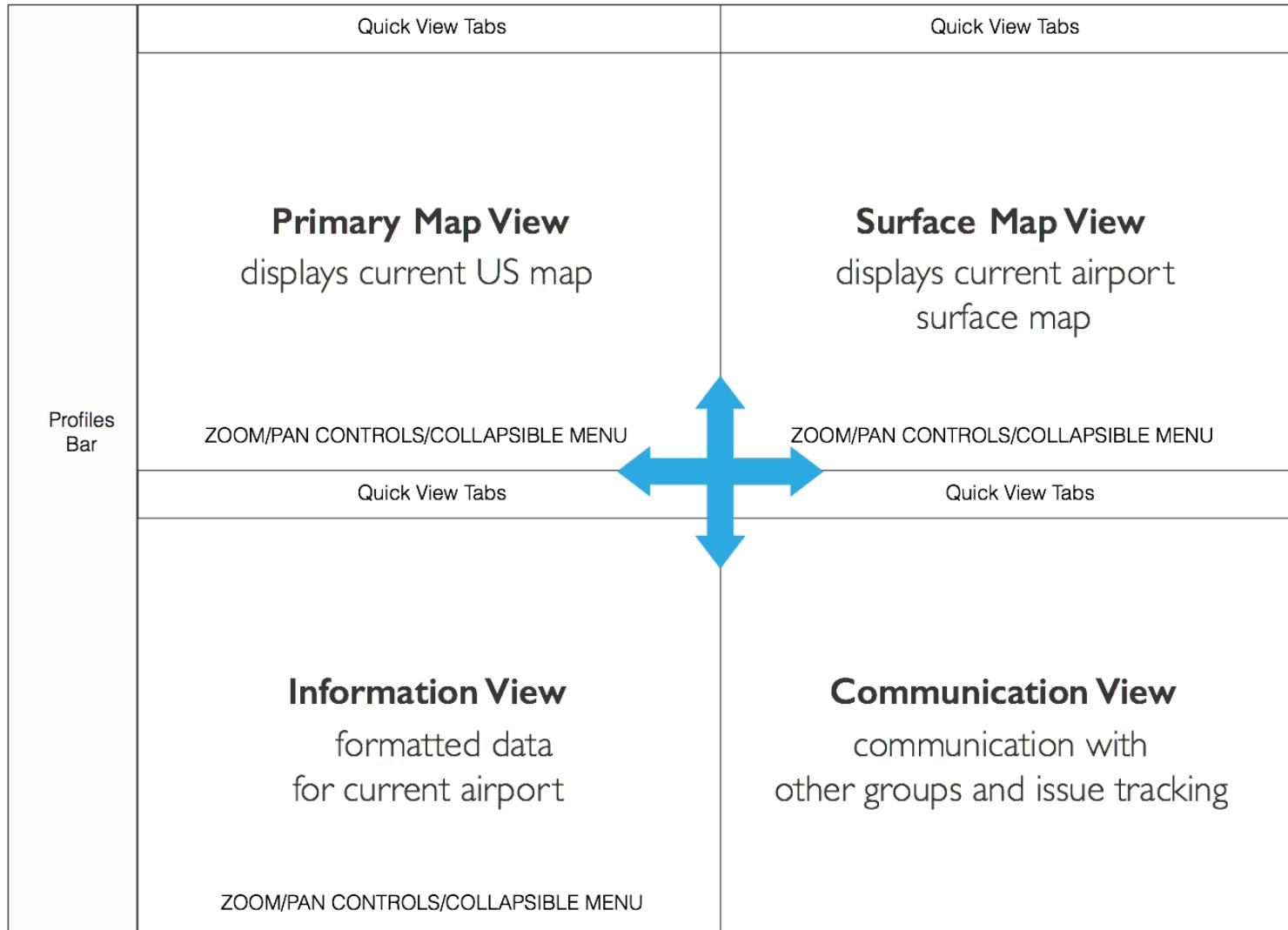
- Weather status and forecasts
- FAA Winter Weather Dashboard
- Prediction/reporting of runway closures for snow/ice treatment
- Runway braking action
- Visual display of surface traffic movement at airport
- Airport runway configuration (capacity)
- De-icing durations, type of fluid needed, throughput times
- FAA actions (e.g., ground stops, miles-in-trail, etc.)

FACT Information



- Notices to Airmen
- FAA Operational Information System
- Aviation Digital Data Service icing information
- Taxi times (from gate push back to departure, including de-icing)
- Runway visual range
- Tracking of arrival flights in en route airspace to determine if hold or divert will be needed

FACT Design



FACT User Interface Design



The screenshot displays the FACT User Interface with two main panels: a Primary Map on the left and a Surface view on the right. The Primary Map shows a grayscale map of the United States with various airports labeled with three-letter codes. A yellow arrow points from the map to the Surface view, which is a 3D perspective view of an airport runway and surrounding terrain. Below the maps are two tables of ATCSCC advisories and a message queue.

ATCSCC ADVISORIES FOR WEDNESDAY, 06-10-2015

#	Control Element	Date	Brief Title	Sender
004	FCAA16	06/10/2015	CDM Airspace Flow Program CNX	06/10/15 00:18
003	ATL/ZTL	06/10/2015	CDM Ground Delay Program	06/10/15 00:14
002	LGA/ZNY	06/10/2015	CDM Ground Delay Program CNX	06/10/15 00:13
001	DCC	06/10/2015	Reroute Cancellation	06/10/15 00:05

ATCSCC ADVISORIES FOR WEDNESDAY, 06-10-2015

#	Control Element	Date	Brief Title
161	DCC	06/09/2015	Reroute Cancellation
160	DCC	06/09/2015	ATCSCC ADV/ZY 160 DCC 06/09/15 Route RQD /Flight Name: FLA_TO_NYMETROS

Quicklinks

SURFACE

MESSAGE QUEUE

FACT CHAT

ADVISORIES

SEARCH

PRINT REPORT

SEARCH

LGA: Too many aircraft in de-icing area.

AUTHOR: rmogford

15:30:02

RESOLVE **SHARE** **DELETE**

JFK: UAL 3740 stall in de-icing area. Expect a 20 min delay.

AUTHOR: dpeknik

11:18:16

SHARED WITH:

RESOLVE **SHARE** **DELETE**

Comments:

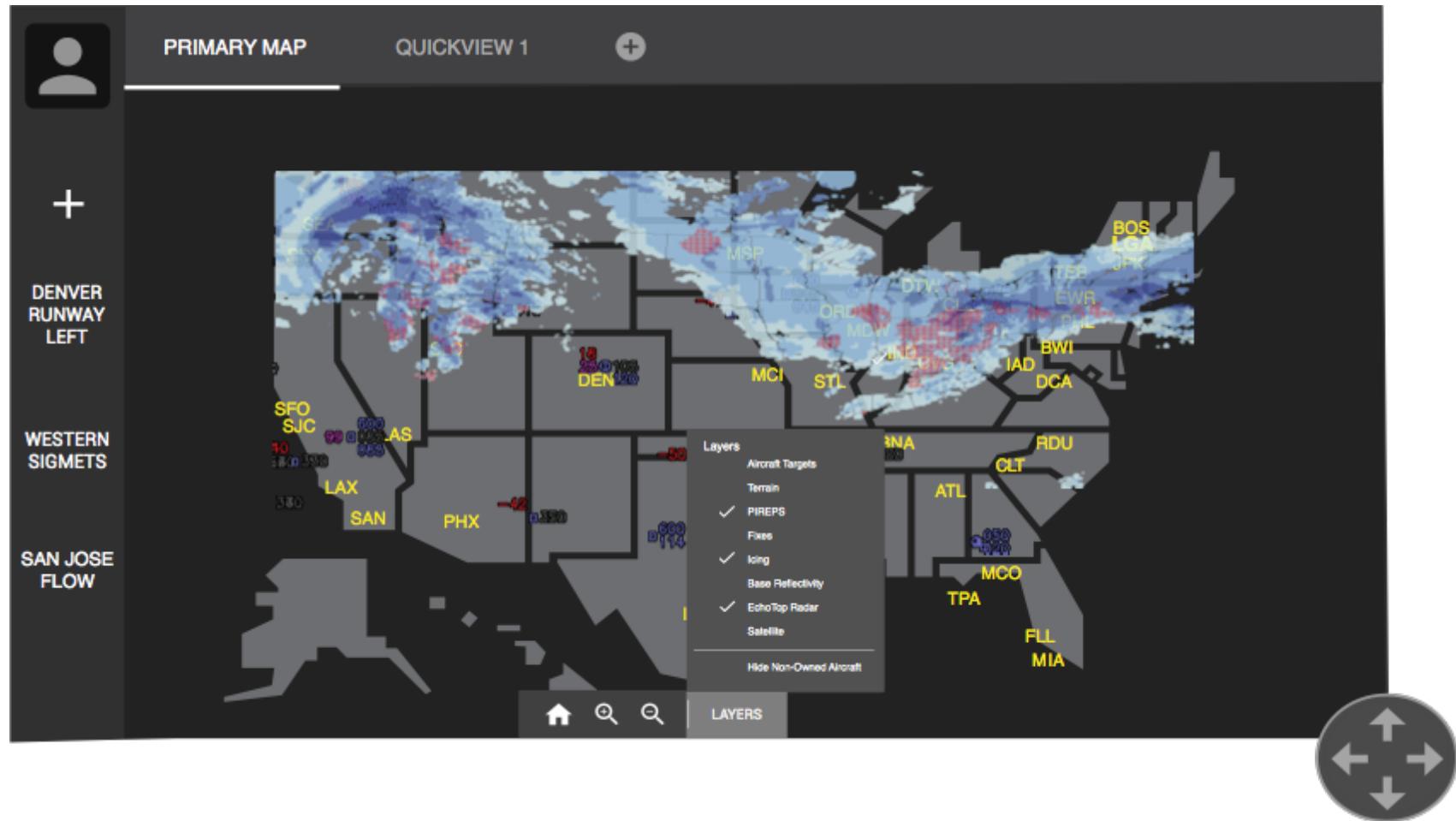
13:30:45 dpeknik: There seems to be a stall in the de-icing area. Can we set a delay? I'll do the calls if needed. **REPLY**

13:42:34 eleong: I say go for it. **REPLY**

13:42:34 rmogford: Let me check and see what our next crew roster says. **REPLY**

(From FACT User Interface Specification document)

Primary Map View



Surface Map View



Information View



PLANNING CHARTS QUICKVIEW 1 +

Search

ATCSCC ADVISORIES FOR WEDNESDAY, 06-10-2015

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001	DCC	06/10/2015		06/10/15 00:05

ATCSCC ADVISORIES FOR WEDNESDAY, 06-10-2015

#	Control Element	Date	Brief Title	Send Time
161	DCC	06/10/2015	WWACM	06/10/15 00:05
160	DCC	06/10/2015	DCC 06/09/15 Route RQD /FL	06/09/15 23:59

Quicklinks

- FAA OIS
- Aviation Weather Center
- FAA NOTAMs
- WWACM

Quicklinks

Name: FLA_TO_NYMETROS
Constrained area: ZJX/ZMA

Information View



Communication View



MY QUEUE FACT CHAT +

ADD QUEUE ITEM PRINT REPORT Search

LGA: Too many aircraft in de-icing area. MORE ▾

AUTHOR: [rmogford](#) 15:30:02 [RESOLVE](#) [SHARE](#) [DELETE](#)

JFK: UAL 3740 stall in de-icing area. Expect a 20 min delay. LESS ▲

AUTHOR: [dpeknik](#) 11:18:16 SHARED WITH: [RESOLVE](#) [SHARE](#) [DELETE](#)

Comments:

13:30:45 **dpeknik:** Not sure how to deal with this one, any suggestions?
Here's the procedure. [attachment](#) [REPLY](#)

13:42:34 **eleong:** That's an old document I believe.
13:42:34 **rmogford:** I'll update and send a new document to the team. [REPLY](#)

Communication View



MY QUEUE

FACT CHAT 6

41 users online

TMC Group

LGA Dispatchers 2

GMTO

AFP Position Managers

Information Team 4

LGA Controllers

JFK Controllers

Hello there...

Richard Mogford 8:56:14 AM

Hello there...

Richard Mogford 8:56:14 AM

It seems like we're getting a lot of warnings about ice and heavy freezing rain.

Richard Mogford 8:56:14 AM

The group is tracking and shows an hour or more...

Richard Mogford 8:56:14 AM

Thanks for the update, have a good one.

Before I forget, there's another front coming in, so stay tuned for additional info.

Richard Mogford 8:56:14 AM

Type your message here & press Enter or the send icon to submit... >

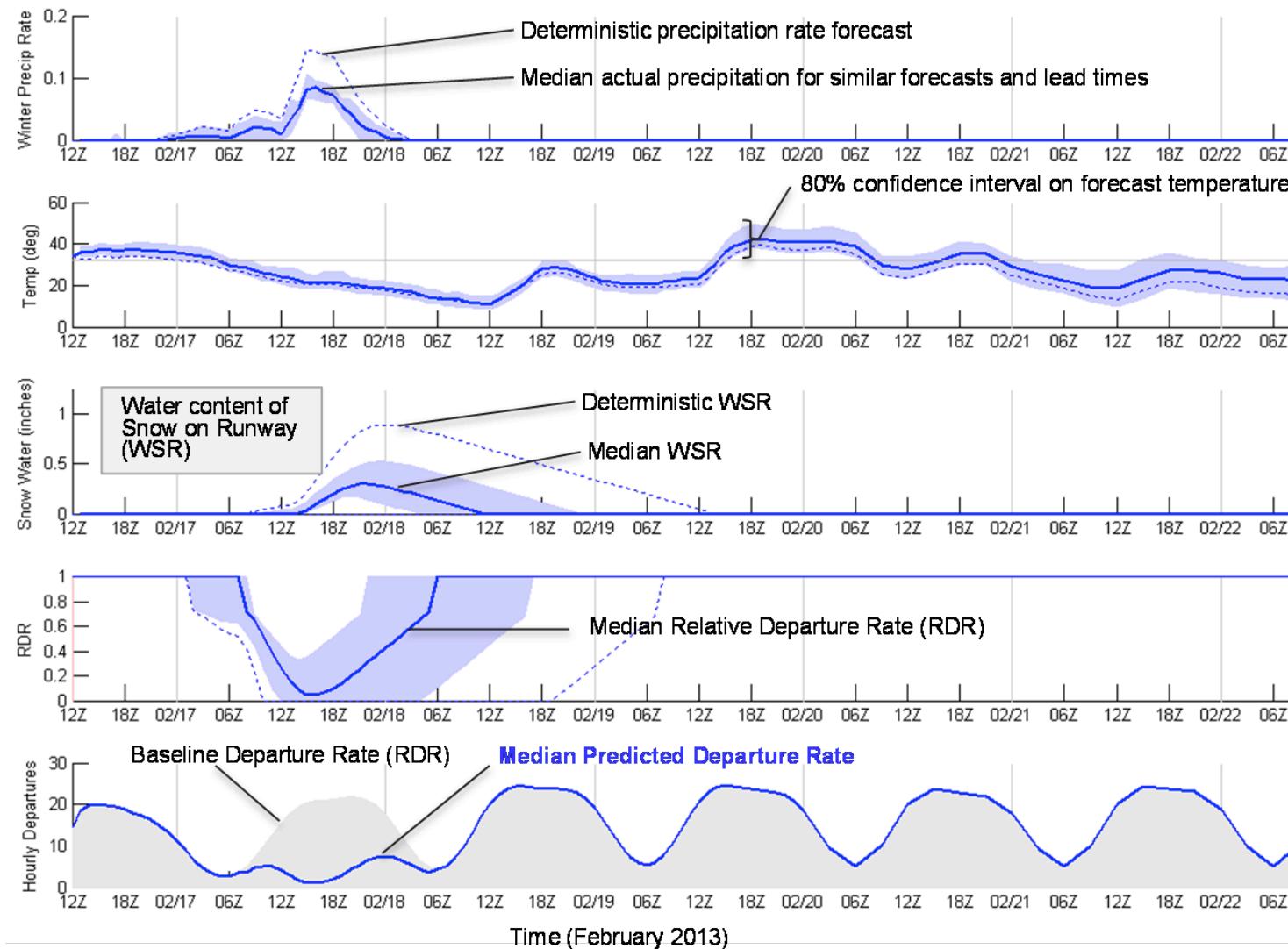
FACT Details



- FACT is a web-based application
- Receives JAVA messages from the FAA System Wide Information Management data repository
- Surface movement data are from ASDE-X
- Data are acquired from web pages and tailored for the Information View
- Predictive tools will be built into FACT
- First one completed is Metron's Winter Weather Airport Capacity Model (WWACM)
 - Predicts changes in airport departure rates from weather forecasts

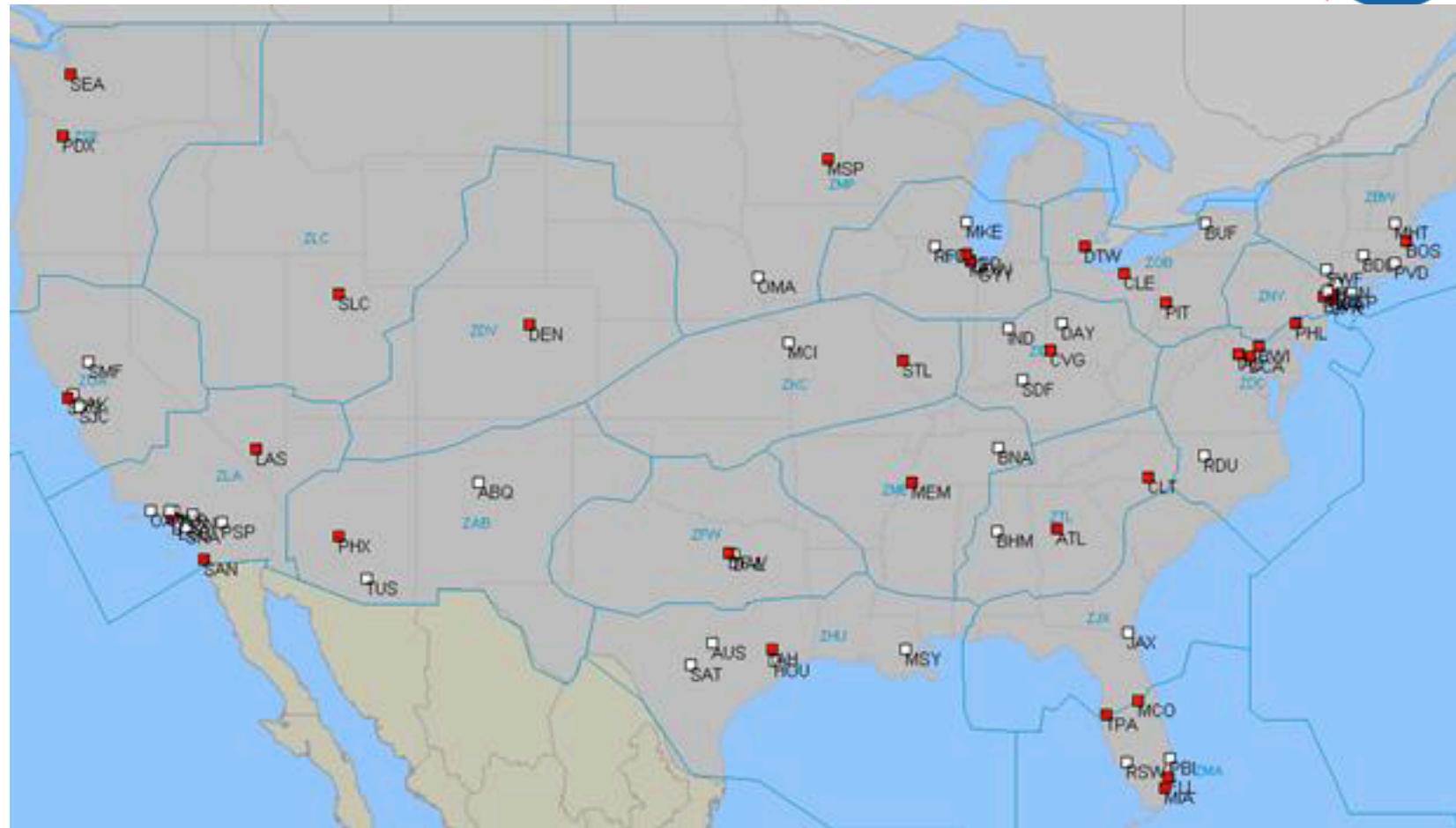
ASDE-X = Airport Surface Detection Equipment, Model X

WWACM



WWACM for BOS for February 16, 2013

WWACM



The 77 airports included in WWACM

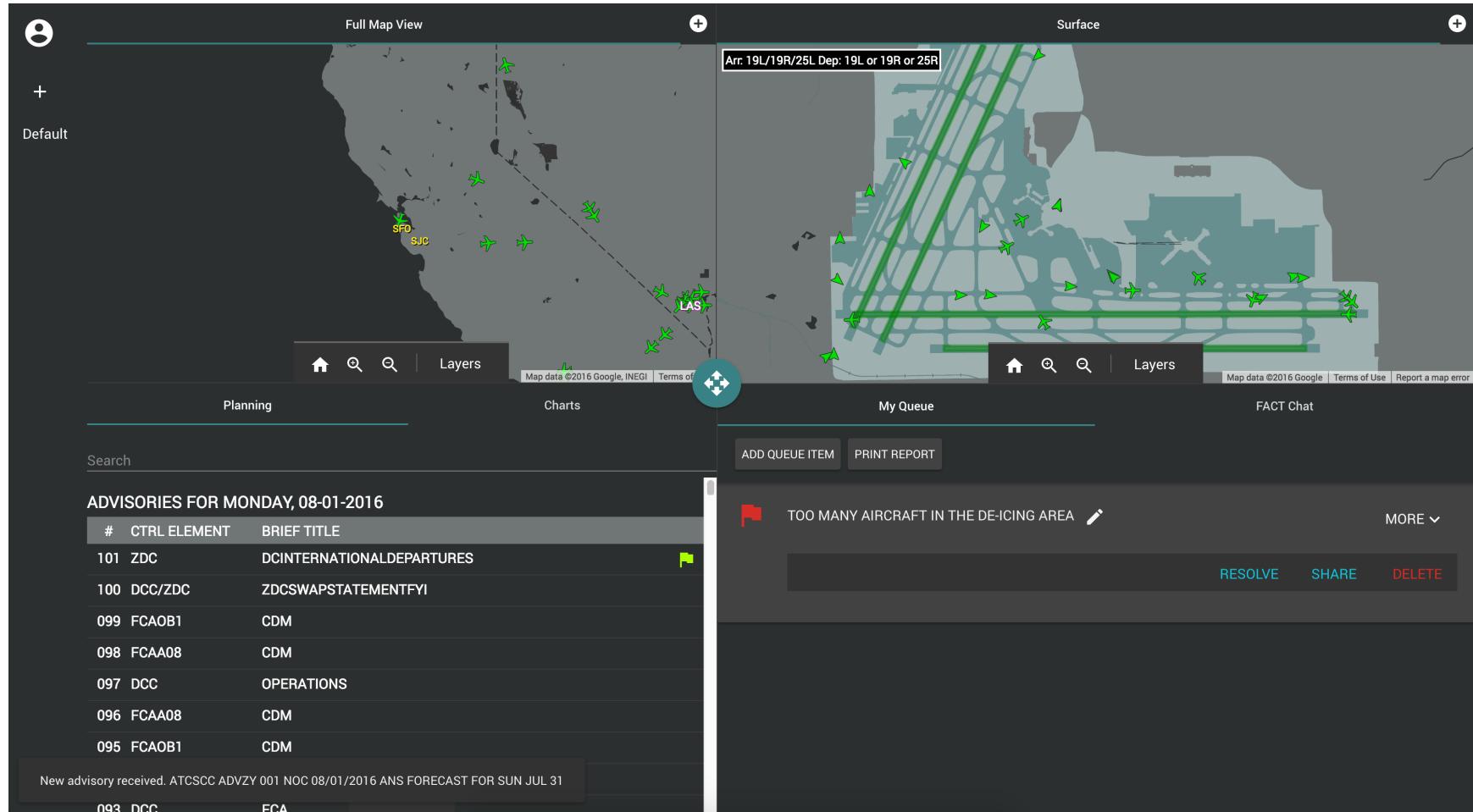
WWACM in FACT



The screenshot displays the FACT software interface, which integrates various flight management and weather-related tools. The top left shows a map of the Western United States with airport codes labeled (SEA, PDX, MSP, ORD, DTW, CLE, BOS, LGA, JFK, SFO, SJC, LAS, SLC, DEN, MCI, STL, IND, CVG, IAD, BWI, DCA, MEM, BNA, ATL, CLT, RDU, TPA, DFW, IAH, MCO, FLL, MIA). The top right shows a 3D perspective view of an airport runway and surrounding terrain. The bottom left is a separate window titled "WINTER WEATHER AIRPORT CAPACITY MODEL (WWACM)" showing a graph of "Airport Capacity Forecast for JFK as of 01/21/2012 0800Z". The graph plots "Capacity Available" (blue line) and "Capacity Required" (red line) against time, with a shaded area representing the difference. The bottom right shows a "FACT CHAT" window with a list of messages:

- 15:30:02 LGA: Too many aircraft in de-icing area. AUTHOR: rmogford MORE ▾
RESOLVE SHARE DELETE
- 11:18:16 JFK: UAL 3740 stall in de-icing area. Expect a 20 min delay. AUTHOR: dpeknik LESS ▾
RESOLVE SHARE DELETE
- Comments:
13:30:45 dpeknik: There seems to be a stall in the de-icing area. Can we set a delay? I'll do the calls if needed. [attachment](#) REPLY
- 13:42:34 eleong: I say go for it. REPLY
- 13:42:34 rmogford: Let me check and see what our next crew roster says. REPLY

FACT Prototype



Full Map View

Surface

Default

Planning

Charts

My Queue

FACT Chat

ADVISORIES FOR MONDAY, 08-01-2016

#	CTRL ELEMENT	BRIEF TITLE
101	ZDC	DCINTERNATIONALDEPARTURES
100	DCC/ZDC	ZDCSWAPSTATEMENTFYI
099	FCAOB1	CDM
098	FCAA08	CDM
097	DCC	OPERATIONS
096	FCAA08	CDM
095	FCAOB1	CDM

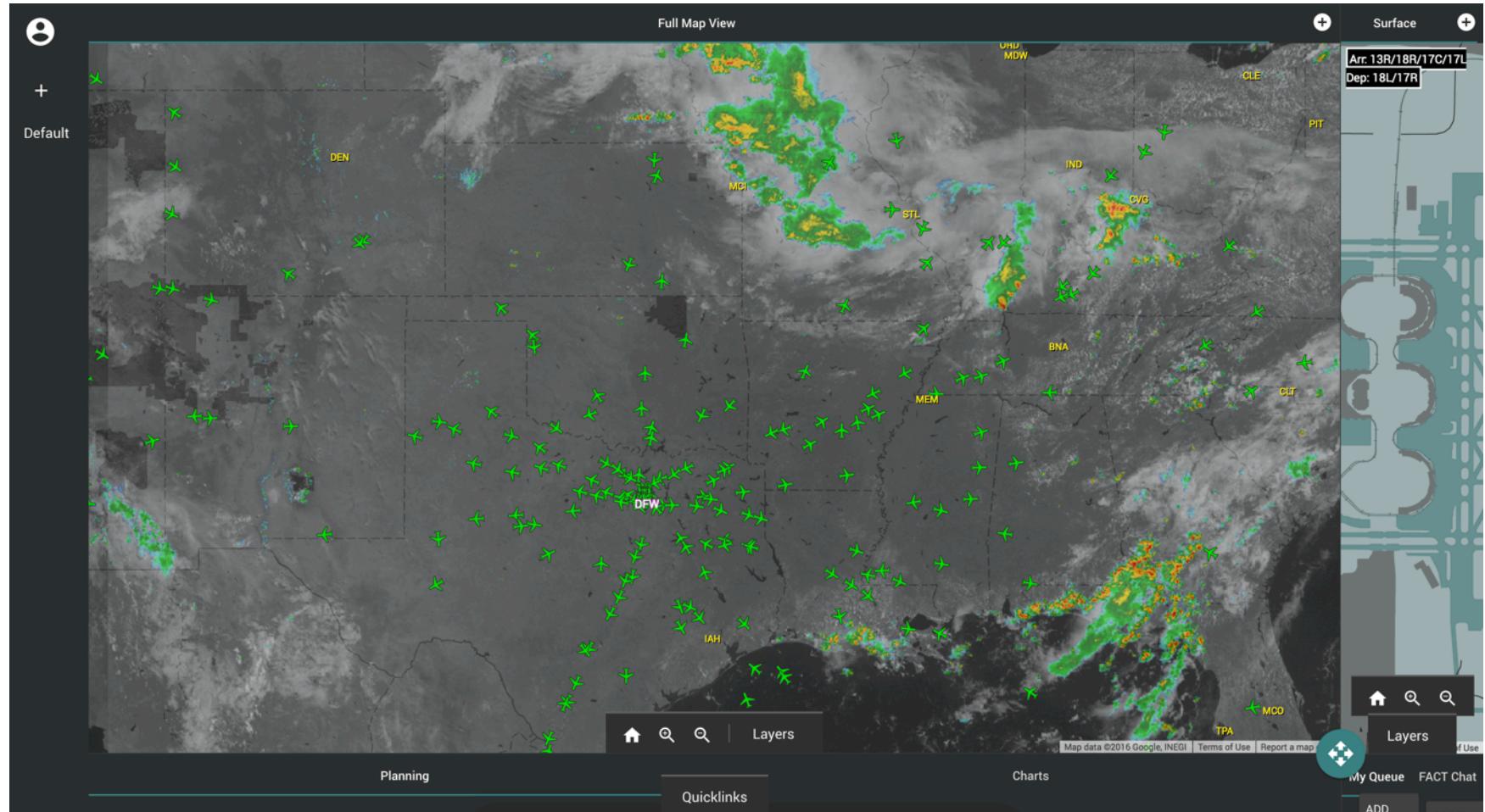
New advisory received. ATCSCC ADVZY 001 NOC 08/01/2016 ANS FORECAST FOR SUN JUL 31

093 DCC FCA

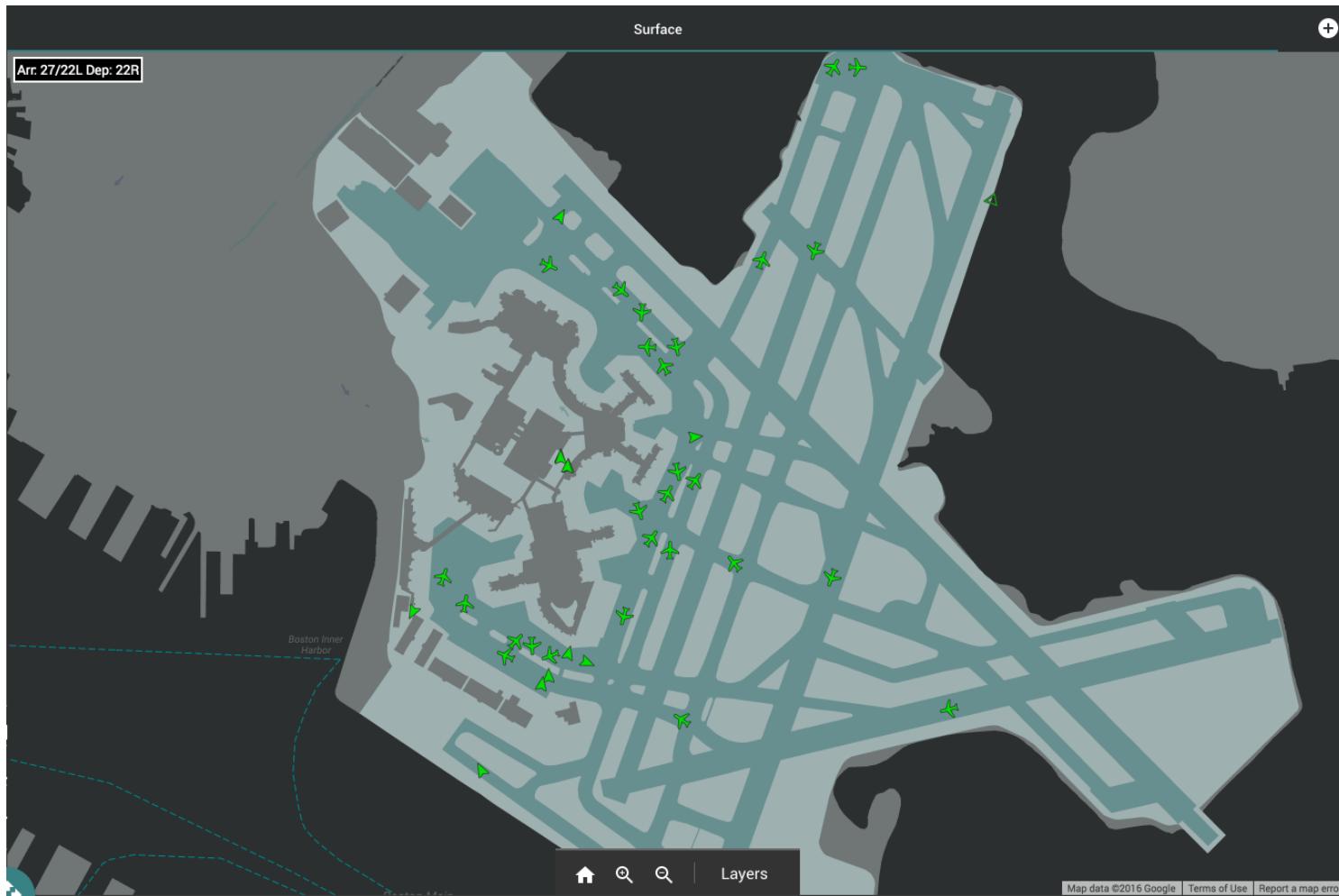
TOO MANY AIRCRAFT IN THE DE-ICING AREA

RESOLVE SHARE DELETE

Primary Map



Surface Map



Information



Search		
ADVISORIES FOR MONDAY, 08-01-2016		
#	CTRL ELEMENT	BRIEF TITLE
101	ZDC	DCINTERNATIONALDEPARTURES
<p>EVENT TIME 01/1900 020500 CONSTRAINED FACILITIES ZDC DC METRO INTERNATIONAL DEPARTURES CAN ANTICIPATE PROBABLE USE OF JERES J220 MICAH TRANSITION INTO ZBW FOR FLIGHTS TO NATOTS THIS IS DUE TO WEATHER ANTICIPATED IN EASTERN ZNY AND ZDC FOR THE AFTERNOON EFFECTIVE TIME 01/1637 02/0500 16/08/01 1637 DCCOPSlxstn20</p>		
100	DCC/ZDC	ZDCSWAPSTATEMENTFYI
099	FCAOB1	CDM
098	FCAA08	CDM
097	DCC	OPERATIONS
096	FCAA08	CDM
095	FCAOB1	CDM
094	DCC	FCA
093	DCC	FCA
092	BWI/ZDC	CDM

Quicklinks

Communication



 TOO MANY AIRCRAFT IN THE DE-ICING AREA 

LESS ^

[RESOLVE](#) [SHARE](#) [DELETE](#)

CREATED DATE: 2016-06-14T00:40:02.000Z
MODIFIED DATE: 2016-08-01T16:44:15.297Z
AUTHOR: admin
SHARED WITH:

F.A.C.T

NOTES:

NOTES ARE EMPTY FOR THIS ITEM

COMMENTS:

00:40:27Z **admin (Me)** test [REPLY](#)

00:40:34Z **admin (Me)** test [REPLY](#)

21:32:56Z **admin (Me)** asdfasdfasdf [REPLY](#)

[ADD A COMMENT](#)

FACT Progress



- Web-based prototype will be completed in mid-2017
- Plan to demonstrate FACT to airlines and airports to seek feedback
- Will make modifications and improvements
- Exploring other prediction tools (e.g., diversions manager, planning snow removal)
- Developing AOC simulator at NASA Ames to evaluate FACT

NASA/Industry Collaboration



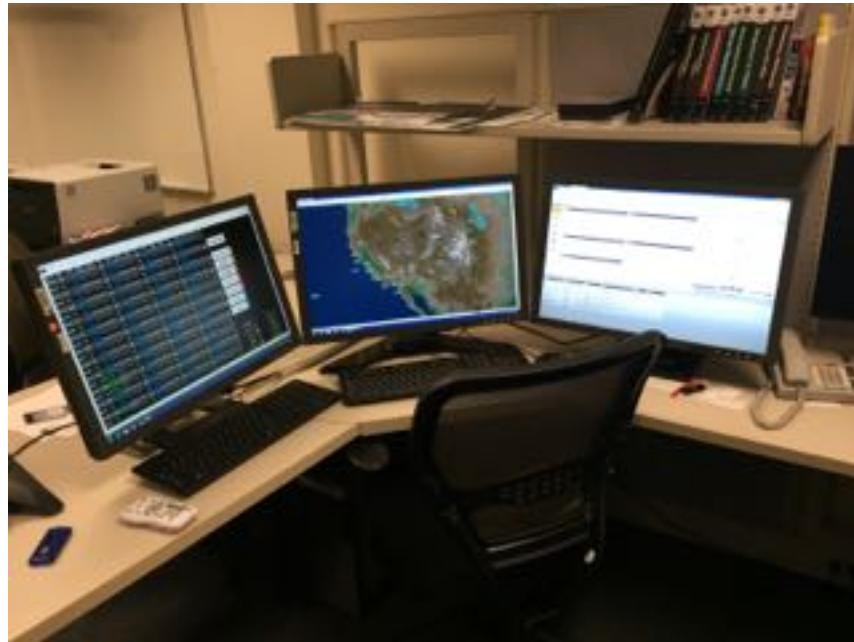
- Held Airline Operations Workshop (AOW) in August 2016 at NASA Ames
 - Three days
 - Around 200 attendees
 - Focused on NASA, FAA, and private sector innovations to support the airlines (AOC and flight deck)
 - Breakout groups identified gaps where research is needed
 - Successful in raising awareness of AOC issues
- AOW research recommendations
 - Improve AOC simulation
 - Study dispatcher workload, situation awareness, errors
 - Display/system integration
 - Managing/accessing large information databases from multiple sources
 - Preferred routes issues

AOW Follow-up



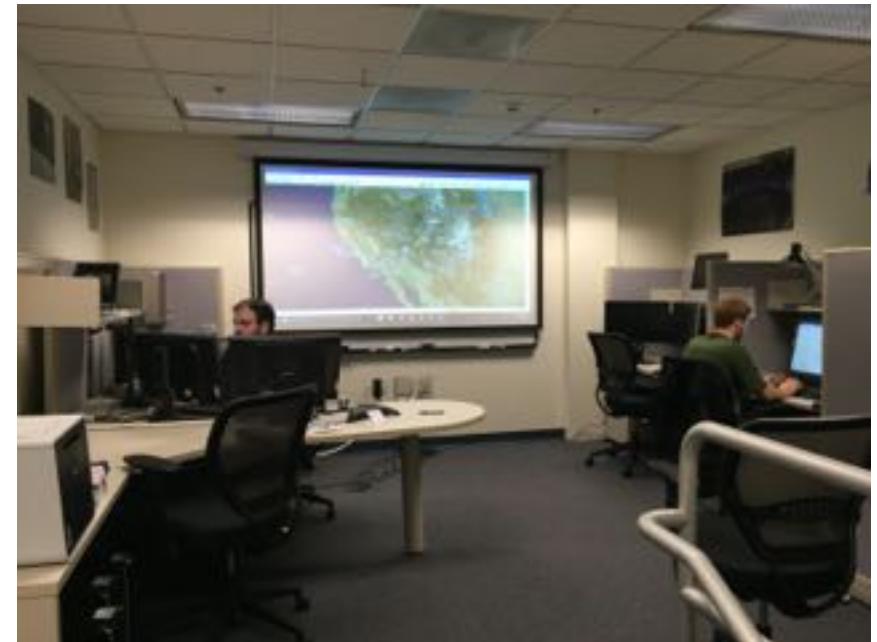
- Virtual meeting
 - Planning a virtual meeting for November 2016 to follow up on recommendations
 - Will form working groups to grow research ideas
- Raising awareness about AOC
 - Briefed NASA AOC topics to DoD Human Systems Community of Interest meeting
 - FAA Infoshare
 - AOC Paper at DASC (Flight Awareness Collaboration Tool Development, Mogford, et al.)
 - Presented at Airline Dispatchers Federation Summit
 - Meeting with US Marine Corps
 - Awarded initial funding from Transformative Aeronautics Concepts Program, Convergent Aeronautics Solutions Project for “Digital Dispatcher” proposal

NASA Ames Airline Operations Research Group (AORG) Laboratory



Working with Ames laboratories to
create an AOC simulation capability

Room 289 in N262





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